DRSS Severity Classification on OCT images

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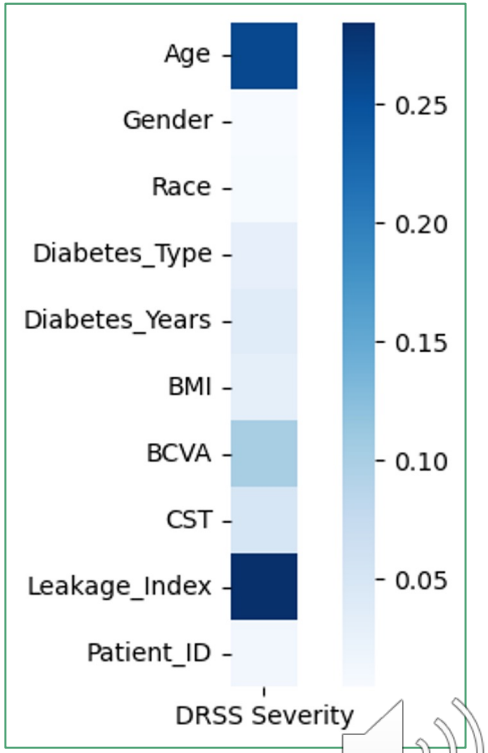
Data Analysis

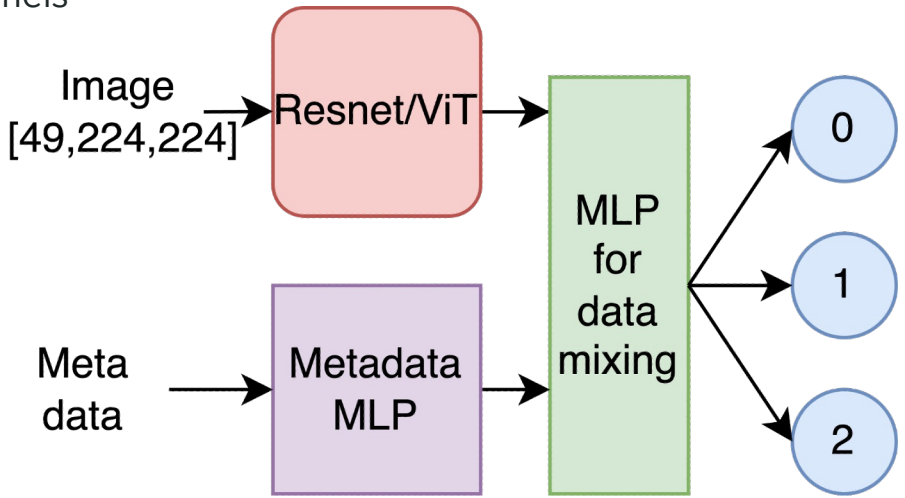
- DRSS Severity in the OLIVES PRIME dataset [1]
  - Three Classes
    - 0: DRSS levels 35 and 43
    - 1 : DRSS level 47 and 53
    - 2: DRSS level 61, 63, 71 and 85.
- Treatment of data as volume of 49 Frames.
- Metadata usage



Metadata Correlation w DRSS

Four Classifications

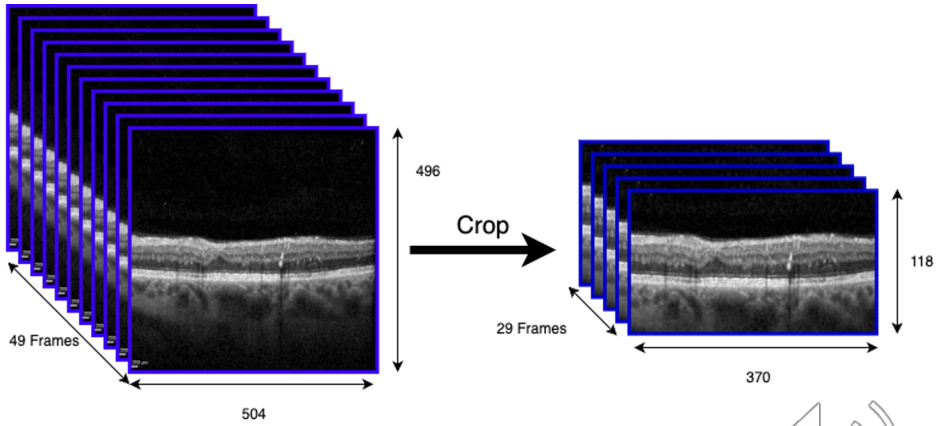
- 3D ResNet18 [2]
  - Expand one channel image to three channels
  - 33.336 M Parameters
- Vision Transformer
  - 3 Encoders, 512 Dim, 8 Heads.
  - 16 M Parameters



Multi-model Layout

Four Classifications

- SVM
  - Image Preprocessing
    - Histogram of Oriented Gradients (HOG)
    - Principal Component Analysis (PCA)
  - Linear Kernel
- K-NN
  - Focus on a smaller section of the image



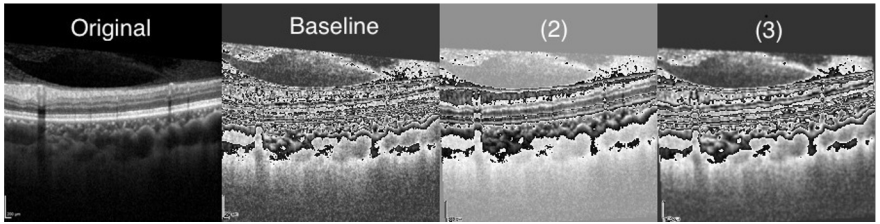
Challenges and Solutions

- Missing image
  - Use Neighbor image
- Imbalance dataset: 0.32 : 0.49 : 0.19
  - Weighted loss function
- Slow Training
  - Checkpointing
  - AutoScaling on V100 GPUs

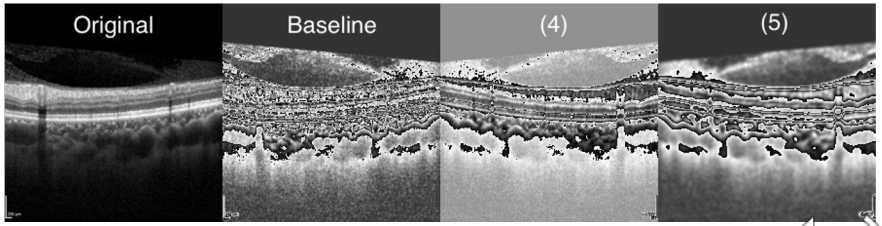
Challenges and Solutions

Small training set in volume granularity (495 Training points, 163 Testing points)

A. Data Augmentation
   1. Baseline transforms: Resize (224, 224) and Normalize
   2. Baseline + Rotation by 3° + Contrast with factor=0.5
   3. Baseline + Rotation by 3° + Gaussian Blur with kernel size=(5, 5)
   4. Baseline + Horizontal Flip + Contrast with factor=0.5
   5. Baseline + Horizontal Flip + Gaussian Blur with kernel size=(5, 5)



Augmentation with Rotation



Augmentation with Horizontal Flip

Evaluation

Method	Test Balanced Accuracy(%)	Specificity	Sensitivity
3D ResNet18	**50.76**	**0.7454**	**0.5076**
ViT	40.66	0.7056	0.4049
SVM	36.80	0.6709	0.3680
K-NN	40.29	0.7188	0.3939

Table 1. Best Accuracy Table

Ablation study - 3D ResNet18

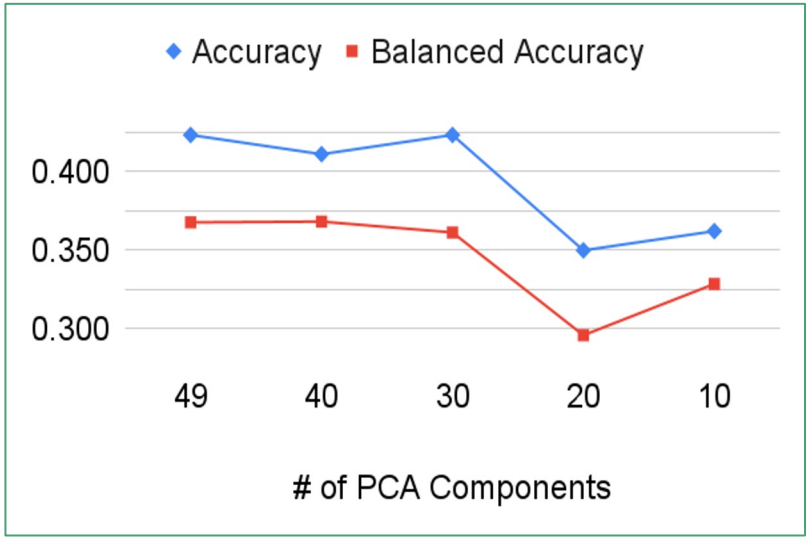
LR	# Metadata Features	Batch 4	Batch 8	Batch 16
1e-4	0	42.91%	46.04%	37.76%
1e-4	2 (Leakage Index, Age)	50.09%	49.53%	**50.76%**
1e-4	9	44.94%	43.78%	45.79%

Table 2. Number of Metadata Features VS. Test Balanced Accuracy

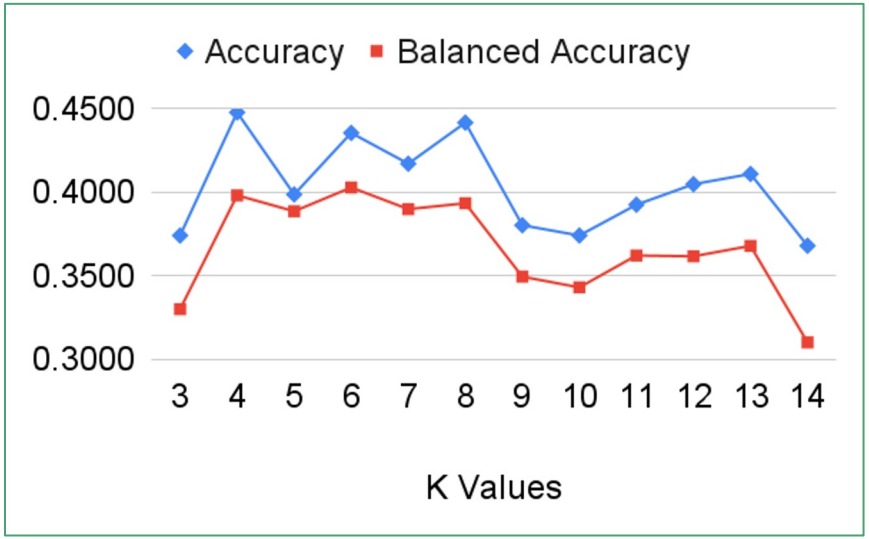
LR	# Metadata Features	Batch 4	Batch 8	Batch 16
1e-3	2	33.33%	33.33%	44.93%
1e-4	2	50.09%	49.53%	**50.76%**
1e-5	2	48.26%	39.32%	38.95%

Table 3. LR VS. Test Balanced Accuracy

SVM and KNN Results



Number of PCA Components vs. Test Accuracy



K Values vs. Test Accuracy

Thank You

GitHub

DropBox

References

[1]: Mohit Prabhushankar, Kiran Kokilepersaud, Yash-yee Logan, Stephanie Trejo Corona, Ghassan AlRegib, \& Charles Wykoff. (2022). OLIVES Dataset: Ophthalmic Labels for Investigating Visual Eye Semantics [Data set]. Advances in Neural Information Processing Systems 35 (NeurIPS 2022), New Orleans. Zenodo. https://doi.org/10.5281/zenodo.710523

[2]: Ellis D.G., Aizenberg M.R. (2021) Trialing U-Net Training Modifications for Segmenting Gliomas Using Open Source Deep Learning Framework. In: Crimi A., Bakas S. (eds) Brainlesion: Glioma, Multiple Sclerosis, Stroke and Traumatic Brain Injuries. BrainLes 2020. Lecture Notes in Computer Science, vol 12659. Springer, Cham. https://doi.org/10.1007/978-3-030-72087-2_4